

Response Under 37 C.F.R. § 1.111
Serial No.: 10/609,481
Sughrue Ref: Q76417

REMARKS

Claims 1-3 are all the claims pending in the application and have now been rejected under § 103(a) as being unpatentable over Kroiss, et al. (German Patent Publication DE 197 51 210 A1) submitted in the IDS filed on July 28, 2004.

Of the pending claims, claim 1 is in independent form with claims 2 and 3 depending directly therefrom. Claim 1 is directed to a non-contact type liquid level sensor. The sensor includes a sensor housing 21, a rotary shaft 22, a float 25, a float arm 26, an annular magnet 23, a pair of arcuate stators 31 and a magnetoelectric transducing element 32. In the Background portion of the application, there is a discussion concerning a sensor disclosed in the Journal of Technical Disclosure No. 2001-4678, issued by Japan Institute of Invention and Innovation. This sensor is illustrated in Figures 13-15 of the subject application. Referring thereto, this reference discloses semi-circular stator 9 having a gap 10 disposed therebetween. As can be seen, the gap is quite small with one of the gaps including a magnetoelectric transducing element therebetween. As discussed in the paragraph bridging pages 3 and 4 of the application, the problem with this arrangement is that the sensor is unnecessarily large.

It is with this in mind that the inventors of the subject application arrived at the invention recited in claims 1-3 of the application. More specifically, as recited in claim 1, and illustrated, for example, in Figure 8, first end of stators 31 have a gap between which the magnetoelectric transducing element 32 is disposed. The opposite second ends of the stators are spaced from each other to form a gap having an opening angle with a range 50° - 200°.

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Sughrue Ref: Q76417

In the rejection, the Examiner contends that the choice of the opening angle is viewed as a matter of “design choice that is well within the purview of one of ordinary skill in the art.” For the following reasons, Applicants disagree.

More specifically, Applicants note that the entire application is focused on the importance of the spacing between the second end of the stators. Referring to Figure 8, according to one preferred embodiment of the invention, the second ends of the stators are separated by an opening angle of 180°. In Figure 9, the gap is defined by an angle of 90°. Further, in Figure 10 the gap is defined by an angle of 120°. Figure 11 is a graph showing the variation of flux density detected by the magnetoelectric transducing element 32 with respect to rotational angle of the magnet 23 in a case where a couple of stators are configured circular. Curve A represents the characteristic curve of the detector discussed in the background portion of the application and summarized above; Curve B represents a characteristic of a detector in which the gap extends an angle of 90° (Figure 9); and Curve C represents the characteristic of the detector where the gap extends an angle of 120° (Figure 10). As shown in Figure 11, the amplitude or flux density of the characteristic Curve B is larger than that of the characteristic Curve A. As a result, since it is already known that the amplitude of Curve A is satisfactory, using the design of Figure 9 (wherein the gap extends an angle of 90°), it is possible to use a magnet having a weaker magnetic force as compared with the magnetic used in related sensor corresponding to Curve A. As a result, the overall cost of the magnet can be reduced. This is discussed in the paragraph bridging pages 15 and 16 of the application.

As summarized beginning on page 17, lines 5+, tests revealed the following:

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- When the opening angle G is 90°, the magnetic flux density exhibits a maximum value;
- when the opening angle of the gap G is 180°, the characteristic of the detector is the same as the characteristic of the related connected discussed in the Background portion of the application and yet the size of the detector can be substantially reduced;
- the minimum angle of 50° is required to cover the minimum swing angle 55° of the float 25; and
- the maximum angle of 200° is selected to ensure that a sensor is not adversely affected by external magnetic force which can cause noise in the sensor.

In view of the above discussed, Applicants submit that the Examiner's assertion that the angle of the air gap is a simple matter of obvious design choice is unfounded. To the contrary, the inventors have discovered that, surprisingly, the above characteristics of the sensor result from the sensor covered by the claimed invention. These results are both surprising and unexpected to a person of ordinary skill in the art.

Furthermore, Applicants note that the Examiner's states that gap 21 of Kroiss corresponds to "second end of the stators" recited in claim 1. However, the gap 21 corresponds, if at all, to "first ends of the statorrs between which the magnetoelectric transducer element is disposed", recited in claim 1 since the hole sensor 22 is disposed in the gap 21 of Kroiss. Thus, Applicants further submit that Kroiss does not teach or suggest "second ends of the stators", as recited in claim 1.

In view of the foregoing, it is submitted that the application is in condition for allowance. If any points remain in issue which the Examiner feels may be best resolved through a personal

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Sughrue Ref: Q76417

or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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